DOCUMENT RESUME

ED 380 310 SE 056 127

AUTHOR Reed, Michelle K.
TITLE Making Mathematical Connections in High School. ERIC Digest.
INSTITUTION ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Columbus, Ohio.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
REPORT NO EDO-SE-95-4
PUB DATE 95
CONTRACT RR93002013
NOTE 4p.; For related digests, see SE 056 125-126.
AVAILABLE FROM ERIC/CSMEE, 1929 Kenny Road, Columbus, OH 43210-1080 (single copies free).
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052) -- Information Analyses - ERIC Clearinghouse Products (071)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Art Activities; High Schools; *Integrated Activities; *Interdisciplinary Approach; *Learning Activities; *Mathematics Instruction; Science Activities; *Secondary School Mathematics; Social Studies; Thematic Approach; Vocational Education; Writing Across the Curriculum
IDENTIFIERS *Connections (Mathematics); ERIC Digests; Language across the Curriculum; *Mathematics Activities

ABSTRACT

Of all the reform recommendations being made by the National Council of Teachers of Mathematics, making mathematical connections is among the more difficult to achieve, especially at the high school level, where so much emphasis is placed on distinct content courses. Mathematical connections can relate mathematical topics to students' daily lives and to other mathematical topics but are probably most important in relating mathematics to other curriculum areas. These connections help students understand mathematics better and see it as a useful and interesting subject to study. This digest gives 18 sample activities appropriate for use in high school classes to connect mathematics to other subjects. It is organized into the following subject headings: language arts, science, social studies, arts, and vocational. (Author/MKR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 380 310

Making Mathematical Connections in High School

by
Michelle K. Reed
ERIC/CSMEE
1929 Kenny Road
Columbus, OH 43210-1080

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

BEST COPY AVAILABLE

ERIC® CSMEE Digest

Clearinghouse for Science, Mathematics, and Environmental Education EDO-SE-95-4 April 1995

Making Mathematical Connections in High School

Michelle K. Reed

Of all of the reform recommendations being made by the National Council of Teachers of Mathematics, making mathematical connections is among the more difficult to achieve, especially at the high school level, where so much emphasis is placed on distinct content courses. Mathematical connections can relate mathematical topics to students' daily lives and to other mathematical topics but are probably most important in relating mathematics to other curriculum areas. These connections help students understand mathematics better and see it as a useful and interesting subject to study.

This digest gives samples of activities appropriate for use in high school classes to connect mathematics to other subjects. Resources are listed by subject area and are drawn from a longer annotated bibliography of mathematical connections available from ERIC/CSMEE (see end note).

Language Arts

"Fostering Collaborative Reading and Writing Experiences in Mathematics" offers several collaborative strategies for integrating reading and writing with mathematics instruction. Sample lessons demonstrate the applicability of these strategies across grade levels and across topics in mathematics.

Wood, K. D. (1992, October). Fostering collaborative reading and writing experiences in mathematics. *Journal of Reading, 36*(2), 96-103.

"No Time for Writing in Your Class?" Writing activities do not have to steal precious time from mathematics. Here are ideas for implementing four forms of writing appropriate for the mathematics class: (1) logbooks, (2) journals, (3) expository writing, and (4) creative writing. Specific examples and suggestions for classroom activities for each form of writing are given.

McIntosh, M. (1991, September). No time for writing in your class? *Mathematics Teacher, 84*(6), 423-433.

"Student-Authored Manuals as Semester Projects" describes a learning activity that requires students to write a manual to explain how to apply procedures and algorithms used in mathematics. A list of possible precalculus and calculus topics that can be used in this activity is included.

Hurwitz, M. (1990, December). Student-authored manuals as semester projects. *Mathematics Teacher, 83*(9), 701-703.

"Word Roots in Geometry" offers suggestions for a unit on word study in geometry that includes defining, recognizing, producing, and appreciating the concepts of geometry. Includes lists of terms and their Greek and Latin word origins.

McIntosh, M. E. (1994, October). Word roots in geometry. *Mathematics Teacher, 87*(7), 510-515.

Science

Mechanical devices offer an alternative to computers for exploring mathematical concepts in various curricular areas. **"The Dynamic Discograph"** describes a series of pulleys and wheels that can be used to teach mathematical principles in pattern drawing, locus, rotation in geared systems, gearing, rotational symmetry, regular plane figures, decimals, and chaotic patterns.

Bell, G. (1991, July). The dynamic discograph. *Australian Mathematics Teacher, 47*(2), 4-8.

"How to Make a 'Bucky Ball'" describes how to construct polyhedra to represent molecular structures. Each face forms regular polygons made up of balls. Step-by-step directions are provided to perform the constructions.

Stephenson, P. (1992, September). How to make a "bucky ball." *Mathematics in School, 21*(4), 14-16.

"Implementing the 'Curriculum and Evaluation Standards'" describes two activities to analyze unit-cell structures from a geometric viewpoint and invites students to apply their mathematical understanding to scientific phenomena. Students form models of the simple cube, a building block of crystalline structures, and a methane molecule.

Pacyga, R. (1994, January). Implementing the "Curriculum and Evaluation Standards." *Mathematics Teacher, 87*(1), 43-47.

Recommendations for reform in mathematics and science education advocate the integration of science and mathematics teaching and learning as a means of improving achievement and attitudes within both disciplines. ***Integrating Science and Mathematics in Teaching and Learning: A Bibliography*** is a collaborative effort of the ERIC Clearinghouse for Science, Mathematics, and Environmental Education; the National Center for Science Teaching and Learning; the National Science Foundation; and the School Science and Mathematics Association to suggest resources for classroom teachers, teacher educators, curriculum developers, and educational researchers interested in the integration of science and mathematics teaching and learning. The bibliography of 555 citations is divided into five sections: (1) Curriculum, (2) Instruction, (3) Research, (4) Curriculum-Instruction, and (5) Curriculum-Evaluation.

Berlin, D. F. (1991, August). *Integrating science and mathematics in teaching and learning: A bibliography*. Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education. (ED 348 233)

"Sharing Teaching Ideas" describes three activities designed to increase student participation in the classroom. The first uses reports of earthquake intensity on the Richter scale to study logarithms. The second discusses student-generated examples to introduce probability. The third activity uses prepared handouts and study groups to promote student interaction and involvement in calculus classes.

BEST COPY AVAILABLE

Tometsko, N. R. (1991, October). Sharing teaching ideas. *Mathematics Teacher*, *84*(7), 541-546.

Social Studies

"Civic Mathematics: A Real-Life General Mathematics Course" presents a civic mathematics curriculum that considers issues of race and gender, poverty and wealth, the environment, and teen issues. Includes lists of mathematical skills reflected in the issues and a sample lesson on water resources. Quarterly projects are suggested as an alternative to exams.

Vatter, T. (1994, September). Civic mathematics: A real-life general mathematics course. *Mathematics Teacher*, *87*(6), 396-401.

The Power of Numbers: A Teacher's Guide to Mathematics in a Social Studies Context: An Interdisciplinary Curriculum provides mathematical experiences in real-world contexts that help students interpret, experiment, communicate, and look for multiple solutions to complex problems. The curriculum uses mathematics to help students develop higher-order thinking and communication skills. Real-world contexts give students a reason to learn and remember mathematical skills and concepts and shows them how these ideas are applied in actual practice. Thematic contexts include polling, studying trends in census data, and designing a public rail transportation system for Los Angeles. Through these activities, students participate in discussions, interpret and analyze data, make decisions, and present their ideas. Topical chapters begin with an overview and include a list of mathematical concepts, skills, vocabulary, and materials involved in the activities. Handouts are provided at the end of each chapter.

Gross, F. E. (1993). *The power of numbers. A teacher's guide to mathematics in a social studies context: An interdisciplinary curriculum.* Cambridge, MA: Educators for Social Responsibility (23 Garden Street, Cambridge, MA 02138). (ED 370 872)

"Bringing Knowledge of Women Mathematicians Into the Mathematics Classroom" describes an activity to attract and retain more female students in mathematics. Visits from women who do mathematics and information about noteworthy women mathematicians are brought into the mathematics classroom. A list of women mathematicians is included.

Friedman, B. (1990, Fall). Bringing knowledge of women mathematicians into the mathematics classroom. *Mathematics and Computer Education*, *24*(3), 250-253.

"Historical Digressions in Greek Geometry Lessons" attempts to combine the history of mathematics in ancient Greece with a course on theoretical geometry taught in Greek secondary schools. Three sections present the history of ancient Greek geometry, geometrical constructions using straightedge and compass, and an application of Ptolemy's theorem in solving ancient astronomy problems.

Thomaidis, Y. (1991, June). Historical digressions in Greek geometry lessons. *For the Learning of Mathematics*, *11*(2), 37-43.

Arts

"The Artist's View of Points and Lines" promotes the idea that art can be used to present early concepts of geometry, including the notion of infinity. Discussed is the symbiosis that exists between the artistic and mathematical views of points, lines, and planes. Geometric models in art and using art in the classroom are also discussed.

Millman, R. S., & Speranza, R. R. (1991, February). The artist's view of points and lines. *Mathematics Teacher*, *84*(2), 133-138.

From the Ground Up: Modeling, Measuring, and Constructing Houses is part of the *Seeing and Thinking Mathematically in the Middle Grades* series. In this unit students use mathematics to design and construct a model home from the ground up. Through the process of designing floor plans, constructing walls and roofs, and making cost estimates, students explore key concepts in geometry and measurement and engage in problem solving, communication, reasoning, and making connections. Appendices include reproducible blackline masters in both English and Spanish and sample student projects.

Education Development Center. (1993). *From the ground up: Modeling, measuring, and constructing houses.* Portsmouth, NH: Heinemann. (SE 055 609)

The harmonic mean, neglected in favor of the arithmetic and geometric means in modern mathematics, is defined and its historical relationship to music, as presented by Pythagoras, is described in **"Mathematics—A Search for Harmony."** Two geometric constructions present a picture of harmony, and an application in calculating the square root of a number is given.

Arnold, S. (1991, December). Mathematics—A search for harmony. *Australian Mathematics Teacher*, *47*(4), 14-16.

Vocational

"Rates and Taxes" proposes lessons for algebra students using the context of tax calculations to learn about the concepts of slope, split functions, averages, rates, marginal rates, and percents. Students explore ramifications of possible tax revisions.

Esty, W. W. (1992, May). Rates and taxes. *Mathematics Teacher*, *85*(5), 376-379.

"Sharing Teaching Ideas: Career Posters" presents an activity in which students create posters by interviewing someone who uses mathematics in his or her job, describing an actual problem that person might have to solve, and writing a paragraph explaining the problem. The posters created by the students are then used in future mathematics lessons.

Tibbs, P., & Jordan, J. (1994, September). Sharing teaching ideas: Career posters. *Mathematics Teacher*, *87*(6), 410-411.

Note

The items listed above are drawn from a longer annotated bibliography of mathematical connections available for $1.95 from ERIC/CSMEE, 1929 Kenny Road, Columbus, OH 43210-1080. For a complete list of publications in mathematics, science, and environmental education available from ERIC/CSMEE, call 1-800-276-0462.

Finding ERIC Documents

ERIC documents (those having ED or SE numbers) can be read at any library holding an ERIC microfiche collection. Copies can be purchased from the ERIC Document Reproduction Service (EDRS): 1-800-443-ERIC.

For general questions about ERIC, the site of the nearest ERIC collection, or a list of current free and low-cost publications, contact ACCESS ERIC: 1-800-LET-ERIC.

Michelle Reed is a doctoral student in mathematics education at the Ohio State University and is the mathematics education analyst for ERIC/CSMEE. Her interests include the Montessori method and teacher education.

OERI This digest was funded by the Office of Educational Research and Improvement, U.S. Department of Education under contract no. RR-93002013. Opinions expressed in this digest do not necessarily reflect the positions or policies of OERI or the Department of Education.

ERIC Educational Resources Information Center. The nationwide information system initiated in 1966 by the U.S. Department of Education. ERIC is the largest and most frequently used education-related database in the world.

SE 056 127

➤ This digest is in the public domain and may be freely reproduced.◄